Complete Summary

GUIDELINE TITLE

ACR Appropriateness Criteria® acute hand and wrist trauma.

BIBLIOGRAPHIC SOURCE(S)

Rubin DA, Daffner RH, Weissman BN, Bennett DL, Blebea JS, Jacobson JA, Morrison WB, Resnik CS, Roberts CC, Schweitzer ME, Seeger LL, Taljanovic M, Wise JN, Payne WK, Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® acute hand and wrist trauma. [online publication]. Reston (VA): American College of Radiology (ACR); 2008. 9 p. [53 references]

GUIDELINE STATUS

This is the current release of the guideline.

This guideline updates a previous version: Rubin DA, Dalinka MK, Daffner RH, DeSmet AA, El-Khoury GY, Kneeland JB, Manaster BJ, Morrison WB, Pavlov H, Schneider R, Steinbach LS, Weissman BN, Haralson RH III, Expert Panel on Musculoskeletal Imaging. Acute hand and wrist trauma. [online publication]. Reston (VA): American College of Radiology (ACR); 2005. 8 p. [47 references]

The appropriateness criteria are reviewed annually and updated by the panels as needed, depending on introduction of new and highly significant scientific evidence.

COMPLETE SUMMARY CONTENT

SCOPE

DISEASE/CONDITION(S)

Acute hand and wrist trauma

GUIDELINE CATEGORY

Diagnosis

CLINICAL SPECIALTY

Emergency Medicine
Family Practice
Internal Medicine
Nuclear Medicine
Orthopedic Surgery
Radiology

INTENDED USERS

Health Plans
Hospitals
Managed Care Organizations
Physicians
Utilization Management

GUIDELINE OBJECTIVE(S)

To evaluate the appropriateness of initial radiologic examinations for patients with acute hand and wrist trauma

TARGET POPULATION

Patients with acute hand and wrist trauma

INTERVENTIONS AND PRACTICES CONSIDERED

1. X-ray, wrist, hand, or finger
    - Valgus stress and contralateral comparison, thumb
    - Arthrography, thumb
2. Computed tomography (CT), wrist, hand, or finger, without contrast
3. Magnetic resonance imaging (MRI), wrist, hand, or finger, without contrast
4. Magnetic resonance arthrography (MRA), thumb
5. Nuclear medicine (NUC), technetium (Tc)-99m bone scan, wrist and hand
6. Ultrasound (US), wrist, hand, or finger
7. Cast and repeat x-ray wrist

MAJOR OUTCOMES CONSIDERED

Utility of radiologic examinations in differential diagnosis

METHODOLOGY

METHODS USED TO COLLECT/SELECT EVIDENCE

Searches of Electronic Databases

DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

The guideline developer performed literature searches of peer-reviewed medical journals, and the major applicable articles were identified and collected.

NUMBER OF SOURCE DOCUMENTS

Not stated

METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Weighting According to a Rating Scheme (Scheme Not Given)

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Not stated

METHODS USED TO ANALYZE THE EVIDENCE

Review of Published Meta-Analyses
Systematic Review with Evidence Tables

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

One or two topic leaders within a panel assume the responsibility of developing an evidence table for each clinical condition, based on analysis of the current literature. These tables serve as a basis for developing a narrative specific to each clinical condition.

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Expert Consensus (Delphi)

DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS

Since data available from existing scientific studies are usually insufficient for meta-analysis, broad-based consensus techniques are needed for reaching agreement in the formulation of the appropriateness criteria. The American College of Radiology (ACR) Appropriateness Criteria panels use a modified Delphi technique to arrive at consensus. Serial surveys are conducted by distributing questionnaires to consolidate expert opinions within each panel. These questionnaires are distributed to the participants along with the evidence table and narrative as developed by the topic leader(s). Questionnaires are completed by the participants in their own professional setting without influence of the other members. Voting is conducted using a scoring system from 1-9, indicating the least to the most appropriate imaging examination or therapeutic procedure. The

survey results are collected, tabulated in anonymous fashion, and redistributed after each round. A maximum of three rounds is conducted and opinions are unified to the highest degree possible. Eighty percent agreement is considered a consensus. This modified Delphi technique enables individual, unbiased expression, is economical, easy to understand, and relatively simple to conduct.

If consensus cannot be reached by this Delphi technique, the panel is convened and group consensus techniques are utilized. The strengths and weaknesses of each test or procedure are discussed and consensus reached whenever possible. If "No consensus" appears in the rating column, reasons for this decision are added to the comment sections.

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

Not applicable

COST ANALYSIS

Not only can magnetic resonance imaging (MRI) accurately show scaphoid fractures, but in cases where no scaphoid fracture is present, the MRI often demonstrate other, unsuspected fractures of the distal radius or carpus, or soft-tissue injuries. In this role, MRI may be cost-effective, especially if immediate MR examination is performed in lieu of presumptive casting, if MRI is done with a limited protocol and at a reduced charge, and if the total cost of presumptive care, including productivity lost from work, is included in the analysis.

METHOD OF GUIDELINE VALIDATION

Internal Peer Review

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

Criteria developed by the Expert Panels are reviewed by the American College of Radiology (ACR) Committee on Appropriateness Criteria.

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

ACR Appropriateness Criteria®

Clinical Condition: Acute Hand or Wrist Trauma

Variant 1: Wrist trauma, first exam.

Radiologic Procedure	Rating	Comments	RRL*
X-ray, wrist	9	Including at least a PA, lateral, and	Min

Radiologic Procedure	Rating	Comments	RRL*
		semipronated oblique. Semisupinated oblique view may increase yield for distal radius fractures, especially when added for ulnar-sided pain.	
CT wrist without contrast	2		Min
MRI wrist without contrast	2		None
NUC Tc-99m bone scan wrist	2		Med
US wrist	1		None
Rating Scale: 1=Least appropriate, 9=Most appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 2: Suspect acute distal radius fracture. Radiographs normal. Next procedure.

Radiologic Procedure	Rating	Comments	RRL*
Cast and repeat x-ray wrist in 10-14 days	8		Min
MRI wrist without contrast	8	If immediate confirmation or exclusion of fracture is required.	None
CT wrist without contrast	5	Only if casted and repeat radiographs are negative.	Min
NUC Tc-99m bone scan wrist	2		Med
US wrist	2		None
Rating Scale: 1=Least appropriate, 9=Most appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 3: Comminuted, intra-articular distal radius fracture on radiographs. Surgical planning

Radiologic Procedure	Rating	Comments	RRL*
CT wrist without contrast	9		Min
MRI wrist without contrast	2		None
NUC Tc-99m bone scan wrist	1		Med
US wrist	1		None
Rating Scale: 1=Least appropriate, 9=Most appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 4: Suspect acute scaphoid fracture, first exam.

Radiologic Procedure	Rating	Comments	RRL*
X-ray wrist	9	Including at least a PA, lateral, and semipronated oblique. The panel recommends the inclusion of a fourth view: a PA projection with ulnar deviation and/or cephalad tube angulation (scaphoid view) if a scaphoid fracture is suspected.	Min
CT wrist without contrast	1		Min
MRI wrist without contrast	1		None
NUC Tc-99m bone scan wrist	1		Med
US wrist	1		None
Rating Scale: 1=Least appropriate, 9=Most appropriate			***Relative**

Radiologic Procedure	Rating	Comments	RRL*
			Radiation Level

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 5: Suspect acute scaphoid fracture. Radiographs normal. Next procedure.

Radiologic Procedure	Rating	Comments	RRL*
Cast and repeat x-ray wrist in 10-14 days	8	Choice of casting or MRI should be tailored to clinical circumstances in the individual case.	Min
MRI wrist without contrast	8	Choice of casting or MRI should be tailored to clinical circumstances in the individual case.	None
CT wrist without contrast	4	A reasonable third option if the above two choices are contraindicated.	Min
NUC Tc-99m bone scan wrist	1		Med
US wrist	1		None
Rating Scale: 1=Least appropriate, 9=Most appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 6: Suspected occult scaphoid fracture. Initial radiographs and repeat radiographs after 10-14 days of casting normal. Continued clinical suspicion of scaphoid fracture. Next procedure.

Radiologic Procedure	Rating	Comments	RRL*
MRI wrist without contrast	9		None
CT wrist without contrast	7	If MRI cannot be performed.	Min

Radiologic Procedure	Rating	Comments	RRL*
NUC Tc-99m bone scan wrist	5	If MRI or CT cannot be performed	Med
US wrist	1		None
Rating Scale: 1=Least appropriate, 9=Most appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 7: Suspect distal radioulnar joint subluxation.

Radiologic Procedure	Rating	Comments	RRL*
X-ray wrist	9	Bilateral wrist CT is indicated in addition to radiographs of the affected side.	Min
CT wrist without contrast bilateral	9	Bilateral wrist CT (pronated and supinated) is indicated in addition to radiographs of the affected side	Min
MRI wrist without contrast	2	Include contralateral wrist for comparison and scan in both supinated and prone positioning.	None
NUC Tc-99m bone scan wrist	1		Med
US wrist	1		None
Rating Scale: 1=Least appropriate, 9=Most appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 8: Suspect hook of the hamate fracture. Initial radiographs normal or equivocal.

Radiologic Procedure	Rating	Comments	RRL*
X-ray wrist	9	Including semisupinated and carpal	Min

Radiologic Procedure	Rating	Comments	RRL*
		tunnel views.	
CT wrist without contrast	9	If additional projections are negative or equivocal.	Min
NUC Tc-99m bone scan wrist	2		Med
MRI wrist without contrast	2		None
US wrist	1		None
Rating Scale: 1=Least appropriate, 9=Most appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 9: Suspect metacarpal fracture or dislocation.

Radiologic Procedure	Rating	Comments	RRL*
X-ray hand	9	Including at least a PA, lateral, and semipronated oblique (off-lateral view).	Min
CT hand without contrast	7	If strong clinical concern exists following negative or equivocal radiograph.	Min
MRI hand without contrast	3	Limited added value.	None
NUC Tc-99m bone scan wrist	1		Med
US hand	1		None
Rating Scale: 1=Least appropriate, 9=Most appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 10: Suspect phalangeal fracture or dislocation.

Radiologic Procedure	Rating	Comments	RRL*
X-ray hand or finger	9	Including at least a PA, lateral, and externally rotated oblique view. Internally rotated oblique is appropriate but not always routine. Either a hand or finger radiograph is indicated.	Min
CT hand or finger without contrast	2		Min
NUC Tc-99m bone scan hand	1		Med
MRI hand or finger without contrast	1		None
US hand or finger	1		None
Rating Scale: 1=Least appropriate, 9=Most appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 11: Suspect thumb fracture or dislocation.

Radiologic Procedure	Rating	Comments	RRL*
X-ray thumb	9	Including at least AP or PA, lateral and rotated oblique.	Min
CT thumb without contrast	5	May be useful for surgical planning for complex, intra-articular fractures of the first metacarpal base.	Min
MRI thumb without contrast	4		None
NUC Tc-99m bone scan hand	1		Med
US thumb	1		None
Rating Scale: 1=Least appropriate, 9=Most appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 12: Suspect gamekeeper injury (thumb MCP ulnar collateral ligament injury).

Radiologic Procedure	Rating	Comments	RRL*
X-ray thumb	9	Including at least a PA and lateral.	Min
MRI thumb without contrast	8	If no fracture visible on radiographs.	None
X-ray thumb with valgus stress and contralateral comparison	6	Controversy concerning accuracy and creation of Stener lesion.	Min
US thumb	6	If expertise exists, reliable alternative to MRI.	None
MR arthrography thumb	3		None
X-ray arthrography thumb	2		Min
CT thumb without contrast	2		Min
NUC Tc-99m bone scan hand	1		Med
Rating Scale: 1=Least appropriate, 9=Most appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Summary of Literature Review

For most patients with trauma of the hand, wrist, or both, radiographs provide adequate diagnostic information and guidance for the treating physician. However, in one large study, wrist fractures, especially those of the distal radius and scaphoid, accounted for more delayed diagnoses than any other traumatized region in patients with initially normal emergency room radiographs. Thus, when initial radiographs are equivocal, or in the presence of certain clinical or radiographic findings, further imaging is appropriate. This may be as simple as additional radiographic projections, or it may include sonography, bone scintigraphy, computed tomography (CT), or magnetic resonance imaging (MRI).

As is true for many extremities, a two-view radiographic examination is not adequate for detecting fracture in the wrist, hand, or fingers. In most patients with suspected distal radius fractures, a three-view radiographic examination (posteroanterior [PA], lateral, and 45-degree semipronated oblique) suffices, while a recent study suggests that the routine addition of a fourth projection--a semisupinated oblique projection--would increase the yield for distal radius fractures, which may be visible only on this fourth view. Nevertheless, when high-field or low-field MRI is performed in addition to radiographs, radiographically occult fractures of the distal radius as well as unsuspected fractures of the carpal bones are frequently demonstrated. In injured wrists with normal or suspicious radiographs that do not account for the clinical symptoms, performing MR imaging results in a change in diagnosis in 55% of cases, and a change in management in 66% of cases. However, a recent randomized controlled trial showed that routine performance of an immediate, abbreviated, low-field MRI study in acutely injured wrists did not predict the need for further treatment any better than the combination of physical examination and radiography. Furthermore, there was no statistically significant difference in outcomes measures--including quality of life, time lost from work, and total costs–with this strategy compared to performing radiographs alone. In addition to MRI, multidetector CT can both show radiographically occult carpal fractures and exclude or confirm suspected fractures, when initial radiographs are equivocal, but the panel rated MRI as a more appropriate modality to use before CT, if there are no contraindications to MRI. CT does have an important role in treatment planning when initial radiographs show a complex fracture-dislocation of the carpus.

Successful treatment of distal radius fractures is predicated on re-establishment of radial length, inclination, and tilt, as well as restoration of the articular surfaces. Specifically, the presence of a coronally oriented fracture line, die-punch depression, and more than three articular surface fragments may indicate the need for operative reduction. Less than 2 mm residual step-off of the distal radial articular surface is considered a congruent reduction necessary for good long-term outcome. Most patients with intra-articular fractures of the distal radius develop radiographic radiocarpal osteoarthritis that progresses over time, even when the original fracture was treated with open reduction and internal fixation; however, the development of radiographic osteoarthritis does not correlate with function, even 15 years after initial injury. CT examination reveals involvement of the radiocarpal and distal radioulnar articular surfaces, intra-articular displacements and depressions, and comminuting more accurately than radiographs.

Measurements of articular surface gap and step-off are more reproducible when performed using CT compared with radiographs, and for displacements >2 mm, there is poor correlation between radiographic and CT findings. Thus, in distal radius fractures where there is a high likelihood of intra-articular incongruence (e.g., fractures in young adults, which frequently result from high-energy impact loading), selective or even routine use of CT to supplement the standard radiographic examination is warranted. The distal radial articular surface is best evaluated by multidetector CT with multiplanar reformatted images; if multidetector CT is not available, direct sagittal images can be obtained, but the imaging process may be difficult if the patient has a cast or external fixator. The addition of 3D surface-rendered reconstructions to the standard 2D CT images may increase interobserver agreement and will change planned management of intra-articular distal radius fractures in up to 48% of cases. MRI also shows intra-

articular extension of distal radius fractures more frequently than does radiography and demonstrates concomitant intra-articular soft-tissue injuries—predominantly tears of the scapholunate interosseous ligament—that may affect surgical treatment. However, current evidence suggests that MRI performed immediately at the time of injury has no added value for predicting whether additional treatment will be necessary for soft-tissue injuries, and the panel recommends CT over MRI for surgical planning of complex, intra-articular distal radius fractures.

The diagnosis of distal radioulnar joint (DRUJ) subluxation is problematic. The symptoms and physical findings are often nonspecific, and the condition is difficult to confirm radiographically. Traumatic subluxation or dislocation of the DRUJ may occur as an isolated injury or be associated with other conditions. If optimum positioning of the wrist is not possible because of the injury or overlying cast, CT scanning is recommended. Both wrists should be scanned simultaneously in both pronated and supinated positions. While this examination can also be performed with MRI, repositioning the patient and scanning both wrists is logistically more complex, more time-consuming, and less comfortable with MRI compared to CT.

An additional fourth radiographic projection--an elongated PA view with approximately 30 degrees of cephalad beam angulation and the wrist positioned in 10 to 15 degrees of ulnar deviation--is recommended as a routine whenever there is clinical suspicion of a scaphoid fracture. However, scaphoid fractures are notoriously difficult to see on initial radiographs (regardless of the views), being radiographically occult in up to 20% of cases. Standard practice in patients with clinically suspected scaphoid fractures but normal initial radiographs is to apply a cast and to repeat the clinical evaluation and radiographs in 10 to 14 days, when resorption at the fracture line may make previously occult fractures visible. If the repeat radiographs are still normal, or equivocal at that time and there continues to be a strong clinical suspicion of scaphoid fracture, imaging with a second modality -- bone scintigraphy, CT, or MRI -- is indicated. There is little evidence favoring either scintigraphy or CT in this scenario, while a recent meta-analysis found that MRI is superior to scintigraphy for showing occult scaphoid fractures. A survey of worldwide institutions found that MRI is most commonly used in these cases, although many hospitals still do CT or scintigraphy, and the choice of modality often depends on local preferences, expertise, and equipment.

Recent studies have evaluated the role of tomography, ultrasonography, scintigraphy, CT, and MRI (with standard equipment or a dedicated, extremity-only scanner), in uncertain cases of scaphoid fracture at the time of or shortly after the initial injury. If one or more of these studies is sufficiently sensitive and specific, presumptive casting can be eliminated in normal cases, and definitive care can be instituted earlier for fractures.

A tomographic wrist examination using a Panorex machine has been suggested to help clarify cases where the initial four-view radiograph is suspicious, but the panoramic study requires a custom-built adaptor for the wrist, which limits its applicability. Bone scintigraphy, with either delayed images or blood pool images, can be used to identify or exclude radiographically occult scaphoid fractures, but this use of scintigraphy has been largely replaced by MRI, which is both more sensitive and more specific than scintigraphy. Scintigraphic false- positive diagnoses of carpal fractures occur due to bone contusions, osteoarthritis,

avascular necrosis, and osteomyelitis, any of which may be radiographically occult. MRI evaluation for radiographically occult scaphoid fractures can be performed with high-field or low-field equipment, using a whole-body imaging system and appropriate local coil, or using a dedicated extremity MR scanner. Not only can MRI accurately show scaphoid fractures, but in cases where no scaphoid fracture is present, the MRI often demonstrate other, unsuspected fractures of the distal radius or carpus, or soft tissue injuries. In this role, MRI may be cost-effective, especially if immediate MR examination is performed in lieu of presumptive casting, if MRI is done with a limited protocol and at a reduced charge, and if the total cost of presumptive care, including productivity lost from work, is included in the analysis.

Ultrasonography with high-frequency transducers can identify some cases of radiographically occult scaphoid fractures; however, the current evidence does not support the routine use of sonography in these cases. Ultrasound (US) examination is not sensitive enough to preclude presumptive casting when no fracture is seen. Furthermore, US only interrogates the dorsal scaphoid waist, while a large proportion of wrists with clinically suspected occult scaphoid fractures in reality have a fracture of the distal radius or other carpal bone (or another portion of the scaphoid); all these cases would be missed if a negative ultrasound examination were used to avoid casting. CT examination is more sensitive and specific than scintigraphy for diagnosing radiographically occult scaphoid fractures, though it is less sensitive (and shows fewer additional fractures) than MRI in this situation. Nevertheless, the panel felt that CT is a reasonable alternative to immediate MRI with a claustrophobic patient or when there is a contraindication to MRI (in cases where a decision has been made not to apply a cast and repeat radiographs).

In summary, radiographically occult scaphoid fractures are relatively common and cause future morbidity when missed. In patients with a strong clinical suspicion of a scaphoid fracture but normal radiographs, the panel feels that either presumptive casting with repeated radiographs in 10 to 14 days or immediate MRI is equally acceptable strategies. The choice will depend on the age, hand dominance, and activity level of the patient, the availability of MRI, and local preferences. If repeat radiographs are normal and the patient remains symptomatic, further imaging is required, and the panel favors MRI as the study of choice. For patients with contraindications to MRI, CT is preferred to scintigraphy.

For the scaphoid bone, not only is identification of the fracture important, but many surgeons recommend immediate operative intervention for displaced scaphoid fractures. As little as 1 mm of displacement is important, resulting in a higher rate of nonunion and avascular necrosis. While CT scanning confined to the direct sagittal plane will underestimate radial or ulnar displacement of scaphoid fractures, evaluations with MRI or multiplanar and/or 3D reconstructions from multidetector CT are more sensitive than standard radiographs for showing small amounts of displacement. In cases where the position of the scaphoid fracture fragments is suspect despite normal radiographs, the panel recommends CT. Similarly, the panel recommends CT examination when there is a question about the age of a scaphoid fracture or its healing.

Compared with the scaphoid, the diagnosis of other carpal bone injuries is less problematic. In specific circumstances, however, supplemental studies in addition to the standard wrist examination are useful. Pisiform fractures are best seen on semisupinated anterior-posterior (AP) or carpal tunnel projections, which project the pisiform volar to the rest of the carpus. The same projections may also demonstrate fractures involving the hook of the hamate that are not visible on the standard radiographs. However, if radiographs fail to show a hamate fracture that is strongly suspected clinically, axial CT examination is indicated.

A standard three-view radiographic examination will reveal most fractures and dislocations of the metacarpals and phalanges. CT may be useful for surgical planning in fracture-dislocations of the carpometacarpal joints. For phalangeal injuries, some practices include a PA examination of the entire hand, while others limit the entire examination to the injured finger. An internally rotated oblique projection in addition to the standard externally rotated oblique may increase diagnostic confidence for phalangeal fractures. Unlike the case for the wrist, low-field MRI is less sensitive than radiographs for hand and finger fractures, and its role is limited to cases where specific abnormalities of the soft tissues – including the collateral ligaments, volar plates, tendons, and pulleys – would affect treatment.

Most fractures of the thumb will be visible on a two-view radiographic examination, although there is a slight increase in diagnostic yield with the addition of an oblique projection, which can be obtained together with a PA examination of the whole hand. Tears of the ulnar collateral ligament of the thumb metacarpophalangeal joint (gamekeeper injury) represent a special problem. Unless there is an associated bony avulsion of the distal metacarpal or proximal phalangeal base, the injury will be radiographically occult. In these cases, a stress examination of the joint with manually applied abduction stress (which can be applied by the patient or the examiner) may show subluxation compared to the contralateral, uninjured side, although there is a theoretical risk of converting a nondisplaced ulnar collateral ligament tear into a displaced one by a stress examination. More important for treatment planning is whether the adductor aponeurosis has become interposed between the torn, displaced ligament and its osseous attachment site--a so-called Stener lesion. Torn ligaments with a Stener lesion require operative repair, while most nondisplaced tears without an interposed aponeurosis will heal with conservative treatment. Conventional arthrography, US, MRI, and MR arthrography have each been advocated to distinguish ulnar collateral ligament tears with and without Stener lesions. The choice of which modality to use will depend on local availability and expertise.

Summary and Recommendations

Radiographs should be the first imaging study in patients with acute wrist, hand, or finger injuries, but the examination must include the correct radiographic projections, which in turn depends on an accurate, site-specific clinical history. Nondisplaced wrist fractures–especially those of the distal radius and scaphoid–may be radiographically occult initially; in cases where there is a strong clinical suspicion of a fracture despite normal radiographs, further evaluation with immobilization and repeat radiographs, CT, or MR imaging is indicated, depending on the clinical circumstances. CT has additional roles for evaluating the articular

surfaces in intra-articular fractures and for detecting specific injuries, including fractures of the hook of the hamate, subluxations of the distal radioulnar joint, and fractures and dislocations of the metacarpal bases. For many indications, including scaphoid bone injuries and ligament injuries at the base of the thumb, MR imaging is the most sensitive examination.

Abbreviations

- AP, anterior-posterior
- CT, computed tomography
- MCP, metacarpophalangeal
- Med, medium
- Min, minimal
- MRI, magnetic resonance imaging
- NUC, nuclear medicine
- PA, posteroanterior
- Tc, technetium
- US, ultrasound

Relative Radiation Level	Effective Dose Estimated Range
None	0
Minimal	<0.1 mSv
Low	0.1-1 mSv
Medium	1-10 mSv
High	10-100 mSv

CLINICAL ALGORITHM(S)

None provided

EVIDENCE SUPPORTING THE RECOMMENDATIONS

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

The recommendations are based on analysis of the current literature and expert panel consensus.

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

Selection of appropriate radiologic imaging procedures for evaluation of patients with acute hand and wrist trauma

POTENTIAL HARMS

Scintigraphic false-positive diagnoses of carpal fractures occur due to bone contusions, osteoarthritis, avascular necrosis, and osteomyelitis.

Relative Radiation Level (RRL)

Potential adverse health effects associated with radiation exposure are an important factor to consider when selecting the appropriate imaging procedure. Because there is a wide range of radiation exposures associated with different diagnostic procedures, a relative radiation level indication has been included for each imaging examination. The RRLs are based on effective dose, which is a radiation dose quantity that is used to estimate population total radiation risk associated with an imaging procedure. Additional information regarding radiation dose assessment for imaging examinations can be found in the American College of Radiology (ACR) Appropriateness Criteria® Radiation Dose Assessment Introduction document (see "Availability of Companion Documents" field).

QUALIFYING STATEMENTS

QUALIFYING STATEMENTS

An American College of Radiology (ACR) Committee on Appropriateness Criteria and its expert panels have developed criteria for determining appropriate imaging examinations for diagnosis and treatment of specified medical condition(s). These criteria are intended to guide radiologists, radiation oncologists, and referring physicians in making decisions regarding radiologic imaging and treatment. Generally, the complexity and severity of a patient's clinical condition should dictate the selection of appropriate imaging procedures or treatments. Only those exams generally used for evaluation of the patient's condition are ranked. Other imaging studies necessary to evaluate other co-existent diseases or other medical consequences of this condition are not considered in this document. The availability of equipment or personnel may influence the selection of appropriate imaging procedures or treatments. Imaging techniques classified as investigational by the U.S. Food and Drug Administration (FDA) have not been considered in developing these criteria; however, study of new equipment and applications should be encouraged. The ultimate decision regarding the appropriateness of any specific radiologic examination or treatment must be made by the referring physician and radiologist in light of all the circumstances presented in an individual examination.

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

An implementation strategy was not provided.

IMPLEMENTATION TOOLS

Personal Digital Assistant (PDA) Downloads

For information about availability, see the "Availability of Companion Documents" and "Patient Resources" fields below.

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Getting Better

IOM DOMAIN

Effectiveness

IDENTIFYING INFORMATION AND AVAILABILITY

BIBLIOGRAPHIC SOURCE(S)

Rubin DA, Daffner RH, Weissman BN, Bennett DL, Blebea JS, Jacobson JA, Morrison WB, Resnik CS, Roberts CC, Schweitzer ME, Seeger LL, Taljanovic M, Wise JN, Payne WK, Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® acute hand and wrist trauma. [online publication]. Reston (VA): American College of Radiology (ACR); 2008. 9 p. [53 references]

ADAPTATION

Not applicable: The guideline was not adapted from another source.

DATE RELEASED

1998 (revised 2008)

GUIDELINE DEVELOPER(S)

American College of Radiology - Medical Specialty Society

SOURCE(S) OF FUNDING

The American College of Radiology (ACR) provided the funding and the resources for these ACR Appropriateness Criteria®.

GUIDELINE COMMITTEE

Committee on Appropriateness Criteria, Expert Panel on Musculoskeletal Imaging

COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE

Panel Members: David A. Rubin, MD; Richard H. Daffner, MD; Barbara N. Weissman, MD; D. Lee Bennett, MD; Judy S. Blebea, MD; Jon A. Jacobson, MD;

William B. Morrison, MD; Charles S. Resnik, MD; Catherine C. Roberts, MD; Mark E. Schweitzer, MD; Leanne L. Seeger, MD; Mihra Taljanovic, MD; James N. Wise, MD; William K. Payne, MD

FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

Not stated

GUIDELINE STATUS

This is the current release of the guideline.

This guideline updates a previous version: Rubin DA, Dalinka MK, Daffner RH, DeSmet AA, El-Khoury GY, Kneeland JB, Manaster BJ, Morrison WB, Pavlov H, Schneider R, Steinbach LS, Weissman BN, Haralson RH III, Expert Panel on Musculoskeletal Imaging. Acute hand and wrist trauma. [online publication]. Reston (VA): American College of Radiology (ACR); 2005. 8 p. [47 references]

The appropriateness criteria are reviewed annually and updated by the panels as needed, depending on introduction of new and highly significant scientific evidence.

GUIDELINE AVAILABILITY

Electronic copies: Available in Portable Document Format (PDF) from the American College of Radiology (ACR) Web site.

ACR Appropriateness Criteria® *Anytime*, *Anywhere*™ (PDA application). Available from the ACR Web site.

Print copies: Available from the American College of Radiology, 1891 Preston White Drive, Reston, VA 20191. Telephone: (703) 648-8900.

AVAILABILITY OF COMPANION DOCUMENTS

The following are available:

- ACR Appropriateness Criteria®. Background and development. Reston (VA): American College of Radiology; 2 p. Electronic copies: Available in Portable Document Format (PDF) from the American College of Radiology (ACR) Web site.
- ACR Appropriateness Criteria® radiation dose assessment introduction. American College of Radiology. 2 p. Electronic copies: Available from the American College of Radiology Web site.

PATIENT RESOURCES

None available

NGC STATUS

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